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# CHRISTMAS TREE CORALS: A NEW SPECIES DISCOVERED OFF SOUTHERN CALIFORNIA

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**A NEW SPECIES OF BLACK CORAL** *was discovered off southern California. The Christmas tree coral (*Antipathes dendrochristos*) was observed from the two-person submersible* Delta *during surveys of benthic fishes on deep rocky banks offshore of Los Angeles. This species forms bushy colonies that grow to three meters in height and width and resemble pink, white, gold, and red-flocked Christmas trees. Christmas tree corals can harbor diverse biological assemblages but were rarely associated with fishes, at least during our daylight surveys. Until our surveys, the occurrence of deep-water black corals off southern California was completely unknown to science. The discovery of the Christmas tree coral clearly demonstrates how much there is yet to learn about marine communities on the seafloor, even along the most populated sections of the west coast.*

## DISCOVERY

As astonishing as it sounds, colonies of a new species of black coral (Figure 1), sometimes up to 10 feet in height, have managed to grow unnoticed practically in the backyard of the 10 million residents in the greater Los Angeles, California area—until now. We first discovered the Christmas tree coral (*Antipathes dendrochristos*) in 1995 while surveying fishes on deep rocky banks using the two-person submersible *Delta* about 40 miles offshore from Los Angeles. A few specimens and many digital images of the unknown coral were collected in 2002 and recently used to publish a description of this new species (Opresko, 2005).

The Christmas tree coral is a colonial Cnidarian (this phylum includes familiar jellyfishes, sea anemones, sea fans and pens, as well as black corals), in the order Antipatharia and the genus *Antipathes* (from Latin and Greek, meaning against [anti-] feeling or suffering [pathos]). As fish biologists, we referred to these unknown organisms as "Christmas trees" when encountering them along our surveys. This is because they resembled multicolored, snow-flocked Christmas trees, replete with ornaments of barnacles, worms, shrimps, and crabs. When it came time to choose a scientific name for the new species, it seemed appropriate to call it *A. dendrochristos* (from Greek, meaning tree [dendro-] of Christ [christos]).

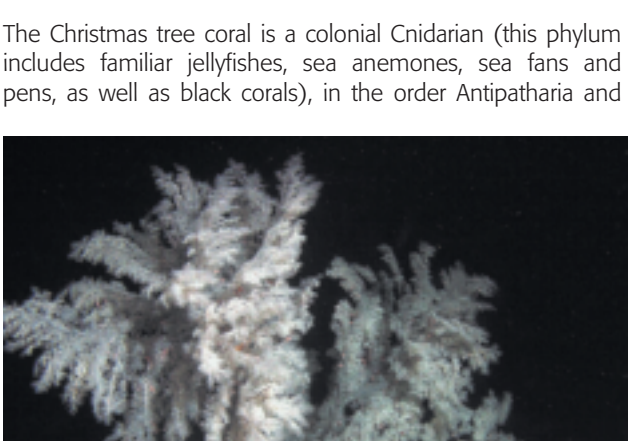

Figure 1. The white color variant of the Christmas tree coral, observed from the manned mini-submersible *Delta* during surveys on rocky banks off southern California in 150 meters water depth.

## DESCRIPTION

Ascending from a substantial hold-fast that is secured to the seafloor, the bushy colonies of the Christmas tree coral are constructed as an upright, rigid black skeleton with multiple branches bearing thorns. While most colonies we have observed are small in height and width (10-50 cm), some have grown to three meters tall. The branchlets of the skeleton are almost completely covered in tiny polyps (Figure 2), which are soft, living organisms that secrete the calcium carbonate skeleton. These polyps are minute (1.0 –1.4 mm in diameter), with tiny blunt tentacles arranged in radial symmetry. While most biological aspects of this species are as yet unknown, it has been proposed that the polyps feed at night, preying on planktonic organisms in the surrounding water. The polyps of black corals living around the Hawaiian Islands are known to bioluminesce when disturbed at night; it is unknown whether Christmas tree corals do the same.

These large graceful colonies occur in a variety of colors, including white, golden, pink-orange, red (Figure 3), and red-brown. It is unknown whether these color variants represent one or more species, and we are working with a molecular biologist to determine taxonomic relationships among the different colored colonies. The Christmas tree coral was differentiated from other species of *Antipathes* based on the arrangement, shape, and size of its branches, thorns, and individual polyps. While most

Figure 2. Close-up view of branchlets of the Christmas tree coral, which are completely covered by tiny living polyps.

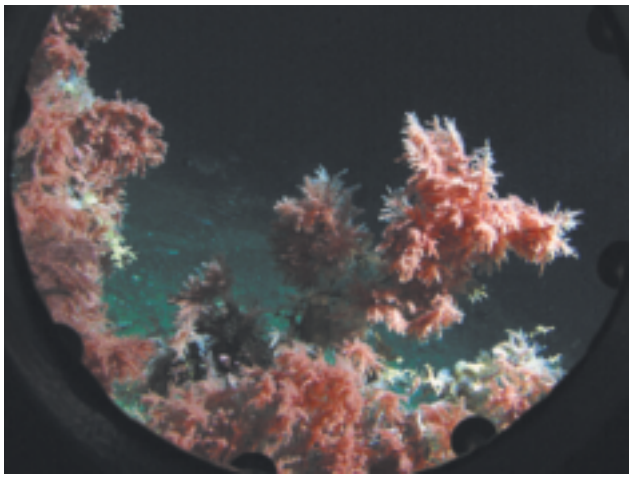

Figure 3. The red color variant of the Christmas tree coral, viewed through the porthole of the mini-submersible *Delta*, at a water depth of 200 meters.

members of this genus have been found in deep tropical waters, the Christmas tree coral resembles several species found off the southern tip of South America.

Since first noticing the Christmas tree corals, we have observed them living around some islands in the Channel Islands National Marine Sanctuary and on several offshore banks in the southern California Bight (Figure 4). Collectively during the past decade, we have made more than 300 dives (about 500 hours underwater) in the *Delta* mini-submersible on many of the major fishing banks off southern California. Our time underwater has been spent conducting a comprehensive survey of benthic fishes (Love et al., 2003), including over 50 species of rockfishes, along with their seafloor habitats, and associated macro-invertebrates (e.g., feather stars, basketstars, brittlestars, sea pens, sponges, corals, among other forms) at water depths of 25 to 330 m. We have covered a wide range of habitats, from sheer high-relief seamounts to low relief cobble fields and flat mud seafloor. While certainly the largest structure-forming invertebrate in our surveys, the Christmas tree coral is relatively uncommon and represents less than two percent of all macro-invertebrates in our study area (Tissot et al., in press). As many as 135 colonies were found to be narrowly distributed at depths from 90 to 300 m, primarily occurring on rocks, boulders, and cobbles mixed with sand and mud along the continental shelf. The colonies often seem to occur in isolated pairs that are separated at most by a few meters.

Like many other coral species, Christmas tree corals support a diverse biological assemblage. Most organisms associated with them are small and difficult to identify and count without collecting entire colonies. Our assessment of associated fauna, thus far, was based on direct observations from the submersible and accompanying videotapes, and from a few specimens collected serendipitously with pieces of the coral. High densities of stalked barnacles occur throughout the branches of many of the colonies. It appears that these barnacles are overgrown or encrusted by the soft tissue of the coral. A relatively large polychaete worm that resembles the coral polyps also lives among the many branchlets. This worm also is undescribed and likely represents an entirely new genus (personal communication with L. Harris, Los Angeles County Museum of Natural History). Large invertebrates and fishes were rarely associated with the colonies in our surveys (Tissot et al., in press). Only about 15 percent of the colonies harbored organisms such as feather stars (crinoids), sponges, small rockfishes and lingcod, basketstars, and galatheid crabs. Some of the larger colonies displayed evidence of damaged or discolored segments; a few specimens seemed entirely dead. These injured or dead colonies were heavily encrusted by a variety of sessile organisms, such as anemones, hydroids, sponges, bryozoans, and shark egg cases (Figure 5).

## FUTURE STUDY

The Christmas tree coral clearly contributes to the diversity, structure, and complexity of seafloor habitats in southern California. Because these organisms could be vulnerable to impacts from at least some fisheries, they may represent habitat areas of particular concern and as such would be protected under the Magnuson Stevens Fishery Conservation and Management Act. However, the association between fishes and these corals remains to be demonstrated. The Christmas tree coral was rarely associated with fishes, at least during the daylight hours of our surveys (Tissot et al., in press). While these corals and many species of rockfishes share the same habitats (i.e., boulders, cobbles, and rocky outcrops at similar water depths), functional relationships between these organisms could not be discerned from videotapes. In addition, beyond the bounds of our surveys, the geographic and bathymetric extents of the distribution of this new species of coral are unknown along the west coast. We hope to pursue more rigorous, quantitative studies, specifically designed to characterize the function of fish and coral associations, as well

as to conduct new surveys of this cold-water coral (and other structure-forming invertebrates) elsewhere off California and northern Baja California to delineate its geographic range.

There is increasing national interest from the science and conservation communities, as well from as the general public, in potential impacts of certain fishing activities on seafloor organisms. Like other species of cold-water corals, the Christmas tree coral likely has a long lifespan (scientists speculate perhaps from 50 to several hundred years), slow growth, a low natural mortality rate, and limited larval dispersal. Corals with this suite of life-history attributes are highly vulnerable to physical disturbance from some heavy fishing gears, and as a result, may take hundreds of years to recover. An overall impression from our surveys in southern California is that the biological components of habitat—that is the structure-forming organisms such as corals, sponges, and other large invertebrates—appear to be flourishing in terms of diversity, density, and size. This seems to be in substantial contrast to perceptions from other areas along the west coast that we have surveyed with the same methods of direct and video observations. This is especially astonishing given that these fairly luxuriant vertical structures are persisting in the southern California Bight, one of the most heavily used areas of the U.S. coast.

We are now beginning to examine this perceived contrast in a quantitative manner, by analyzing the attributes of these biological communities (i.e., their diversity, densities, and sizes) using our archived video library of underwater surveys and by comparing these attributes among geographic areas having histories of different trawling intensity. Because fishing with various gear types has occurred for decades along most, if not all of the west coast, this issue is difficult to evaluate. However, historically there has been relatively little trawling off southern California, particularly on the deep water banks of our studies, compared to the submarine canyons and rocky banks off central California and further north. Our comparisons of deep-water invertebrate communities along the coast could be very compelling in terms of understanding the impacts of fishing on biogenic components of benthic habitats.

As with deep-dwelling, cold-water corals worldwide, most aspects of the taxonomy, biology, and ecology of the Christmas tree coral remain to be studied. Much of what we know about any of these cold-water corals has come from chance

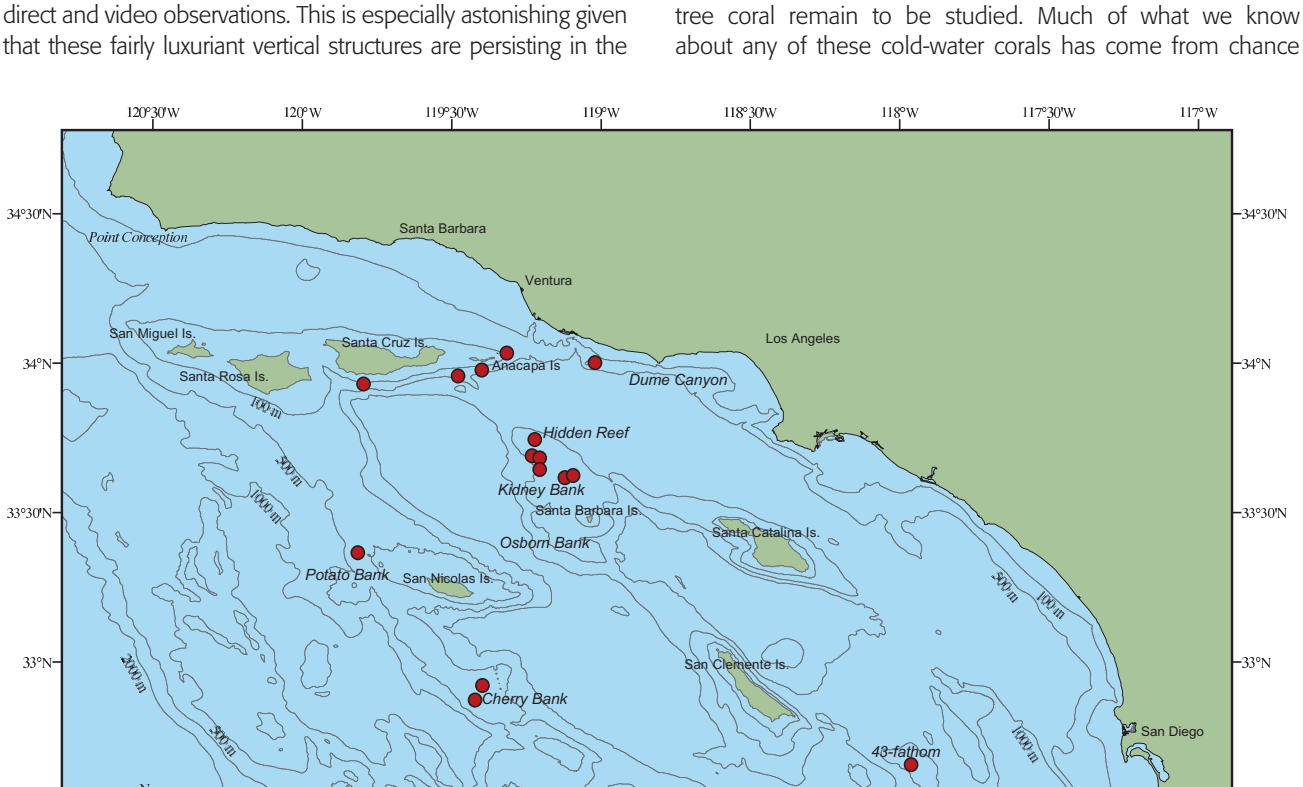


Figure 4. Distribution of Christmas tree coral colonies in southern California assessed from *Delta* mini-submersible during surveys of fishes and habitats on rocky banks.

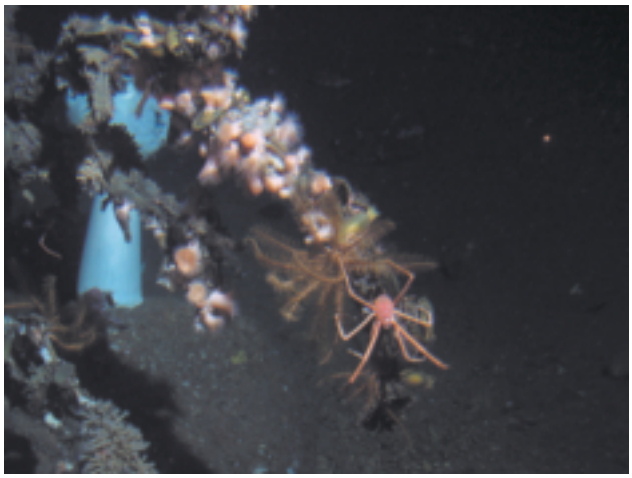

Figure 5. An example of a dead segment of the Christmas tree coral encrusted with many sessile organisms, including anemones, feather stars, galatheid crab, and shark egg cases.

collections during research cruises or as bycatch of bottom-trawl fisheries. Unfortunately, little information on their natural habitats results from such collections. Recent advances in underwater technologies and the increased availability of observational platforms such as manned submersibles and remotely operated vehicles are providing scientists with new opportunities to assess the distribution and abundance of these corals firsthand and up close in their deep-water habitats. Recent explorations and research studies, such as ours, have resulted in the discovery of several new species of corals, and have given new insight into the ecological associations among these corals and the various biogenic and physical components of their habitat. The level of our understanding is directly related to the amount of time spent observing and exploring these deep environments (see McDonough, this issue, for more).

Until our surveys, the occurrence of deep-water black corals off southern California was completely unknown to science. The discovery of the Christmas tree coral clearly demonstrates how much there is yet to learn about marine communities on the seafloor, even along the most populated sections of the west coast. As we proceed with research on age, growth, resiliency to disturbance, and all aspects of the biology and ecology of this new species, it seems prudent to ensure that protective measures are considered.

## ACKNOWLEDGMENTS

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## REFERENCES

Love, M.S., D.M. Schroeder, and M.M. Nishimoto (2003). *The Ecological Role of Oil and Gas Production Platforms and Natural Outcrops on Fishes in Southern and Central California: A Synthesis of Information*. U.S. Department Interior, U.S. Geological Survey, Biological Resources Division, Seattle, WA, OCS Study MMS 2003-032.

Opresko, D.M. (2005). "A New Species of Antipatharian Coral (Cnidaria: Anthozoa: Antipatharia) from the Southern California Bight." *Zootaxa* 852:1-10 (http://www.mapress.com/zootaxa/content.html).

Tissot, B.N., M.M. Yoklavich, M. S. Love, K. York, and M. Amend (in press). "Structure-Forming Invertebrates as Components of Benthic Habitat on Deep Banks off Southern California with Special Reference to Deep-Sea Corals." *Fishery Bulletin*.

## FOR MORE RESOURCES:

Photographs of the Christmas Tree Coral:
**http://santacruz.nmfs.noaa.gov/ecology_branch/habitat_ecology/black_coral**

Video Footage of the Christmas Tree Coral:
**http://www.id.ucsb.edu/lovelab**

## PHOTO CREDITS:

Page 27: Courtesy of M. Amend, NOAA NMFS

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Page 29: Map modified from Tissot et al., (in press)

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